Progress Report

January 1, 1984, through May 31, 1984

Environmental Baseline Survey - Year Two
Kilauea East Rift
Puna and Ka'u Districts, County of Hawaii

report prepared for

State of Hawaii
Department of Planning and Economic Development

By

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I. Introduction

The progress achieved in the performance of the second year of the environmental baseline survey of the Kilauea East Rift zone is described in this report. This is the first progress report for the second year of the survey and covers the period January 1, 1984, through May 31, 1984. A final report for the first year of the survey has been submitted to the Hawaii Department of Planning and Economic Development.

The primary activities during the January 1, 1984, through May 31, 1984, period have been the continued operation of the sulfur dioxide/hydrogen sulfide monitor located in Volcano Village, and the installation and operation of inhalable/respirable particulate monitors (dichotomous samplers) at Volcano Village and at a site located near Leilani Estates (Site 2). As with the earlier progress reports for the first year of the survey, only limited interpretation of the data is presented at this time, since the project can best be described as still being in the data acquisition phase.

II. Sulfur Dioxide and Hydrogen Sulfide Monitor at Volcano Village

The sulfur dioxide (SO_2) and hydrogen sulfide (H_2S) monitor at Volcano Village was established September 12, 1983. Data obtained for the period September 12, 1983, through December 31, 1983, has been included in the first year final report. The report presented here contains the continuous record for the period January 1, 1984, through May 16, 1984. The data collected after May 16, 1984, has not yet been reduced. The instrument was set up to monitor SO_2 from January 1, 1984, through April 2, 1984. The instrument was then converted to monitor H_2S until the end of June when it will again monitor SO_2 for another three months. Since refurbished secondhand instrumentation was used due to monetary restrictions, several episodes of downtime occurred due to instrument malfunction and repair during the H_2S monitoring period. However, during the three month SO_2 period,

only a 1.3% downtime occurred.

Figures 1-6 illustrate typical SO_2 events measured at Volcano Village. Figure 7 illustrates a typical H_2S event. As observed during the first year study at Volcano Village and at the site located behind the National Park Headquarters (Site 4), SO_2 events are much more frequent and reach much higher concentration levels than H_2S events. The concentration of SO_2 reached 434 ppb on February 4, 1984, while the maximum recorded H_2S concentration was only 9 ppb, which occurred on April 20, 1984. Again, as with the data obtained during the first year of the survey, high SO_2 episodes correlate with volcanic activity. Appendix A is a log of the continuous SO_2 and H_2S monitoring.

III. Inhalable and Respirable Particles

Two monitors were set up to monitor inhalable (< 15 μ) and respirable (< 2.5 μ) particles during the first week in January, 1984. One was located adjacent to the SO_2/H_2S monitor in Volcano Village and one was located near the intersection of Highway 130 and Leilani Estates Road. The latter location was referred to as Site 2 in the first year survey and is referred to here as Upper Leilani. The samples are being run on an every six day schedule, and the sampling duration is 48 hours. There has been no lost sampling periods due to downtime, although two sampling periods at the Upper Leilani Site were less than 48 hours in duration due to an electronic malfunction. The first samples were collected on January 6, 1984, and samples have been analyzed for mass and elemental content through April 30, 1984. (Table 1 and Appendix B). The more current samples have not yet been analyzed. The samplers collect two size fractions of particulate material, fine (respirable, < 2.5 μ in aerodynamic diameter) and coarse (2.5 μ - 15 μ in aerodynamic diameter). Inhalable values (< 15 μ in aerodynamic diameter) are produced by summing the values obtained for the simultaneously collected fine and coarse samples.

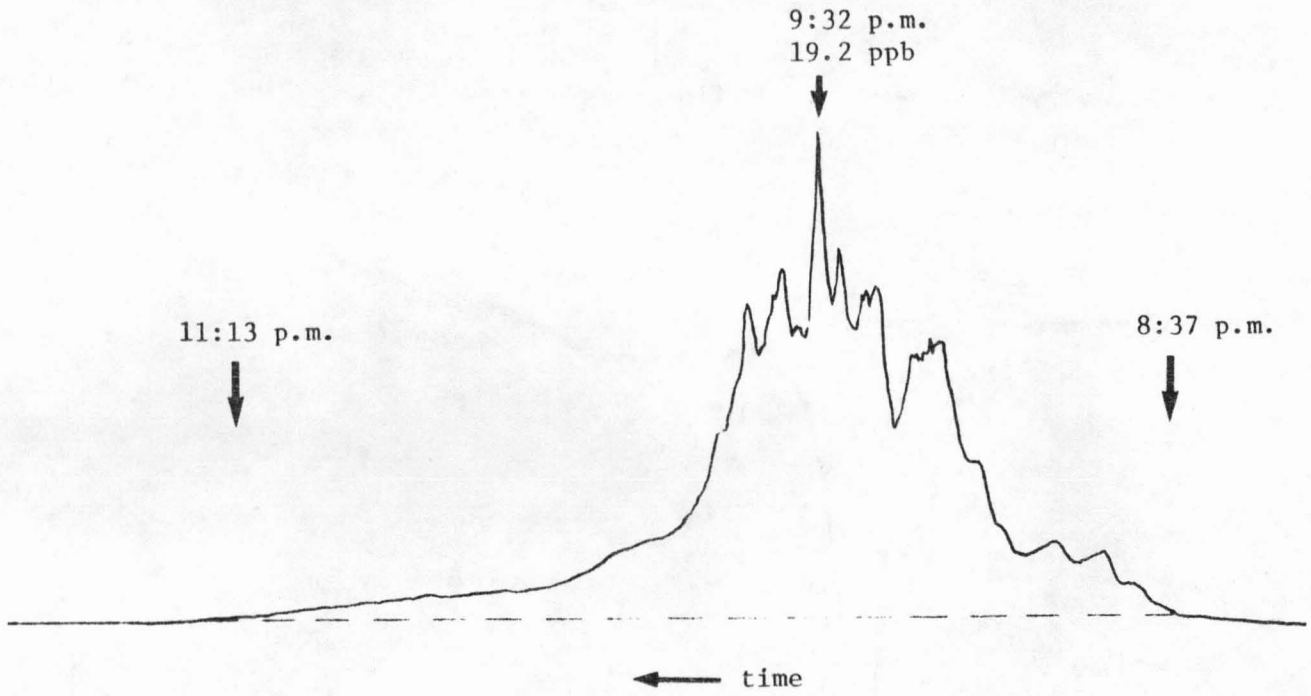

Figure 1. SO_2 Episode Measured at Volcano Village Monitor on 1/1/84. Maximum SO_2 Concentration was 19.2 ppb.

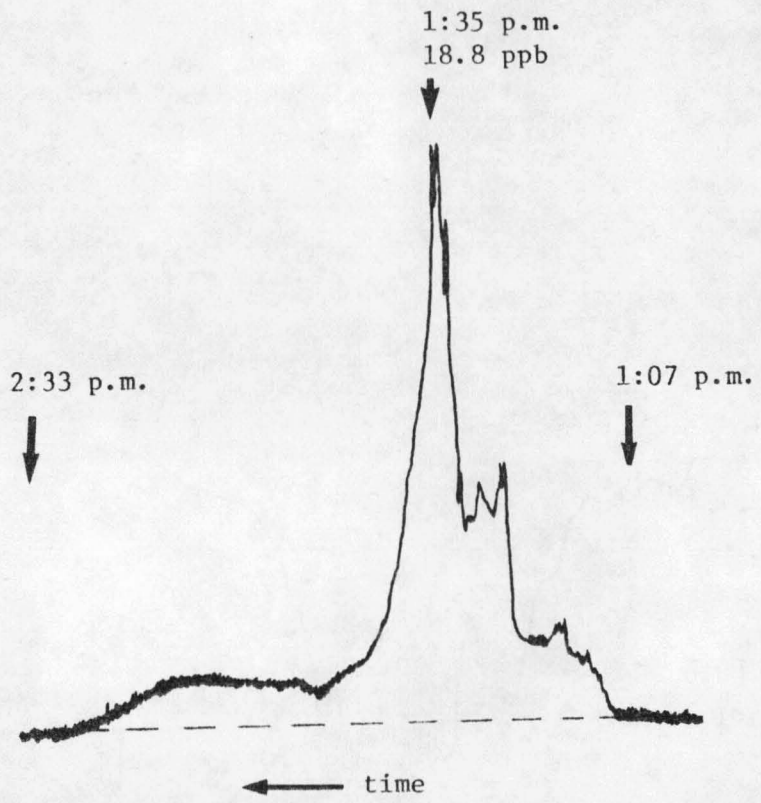

Figure 2. SO_2 Episode Measured at Volcano Village Monitor on 1/14/84. Maximum SO_2 Concentration was 18.8 ppb.

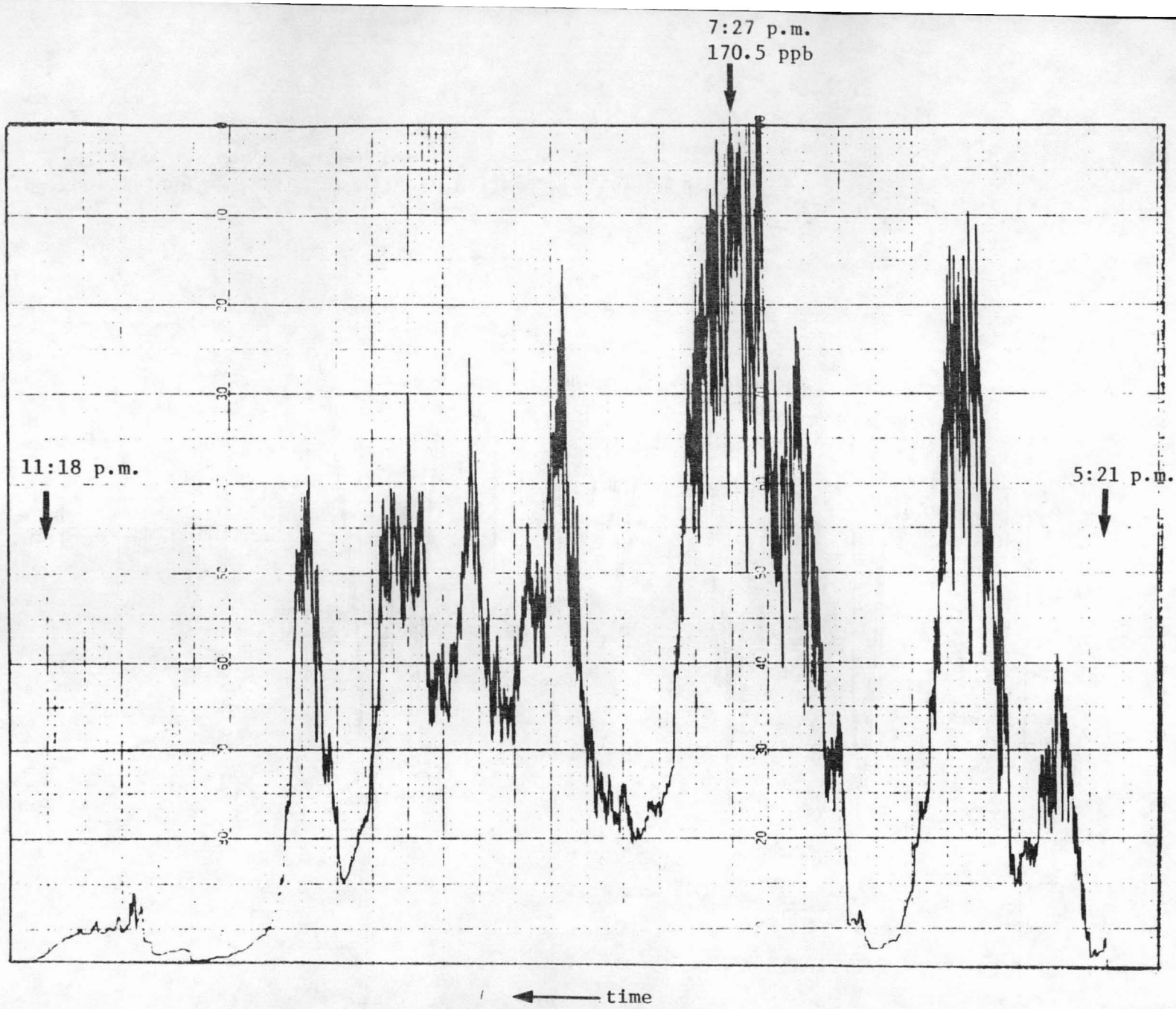

Figure 3. SO_2 Episode Measured at Volcano Village Monitor on 3/1/84. Maximum SO_2 Concentration was 170.5 ppb.

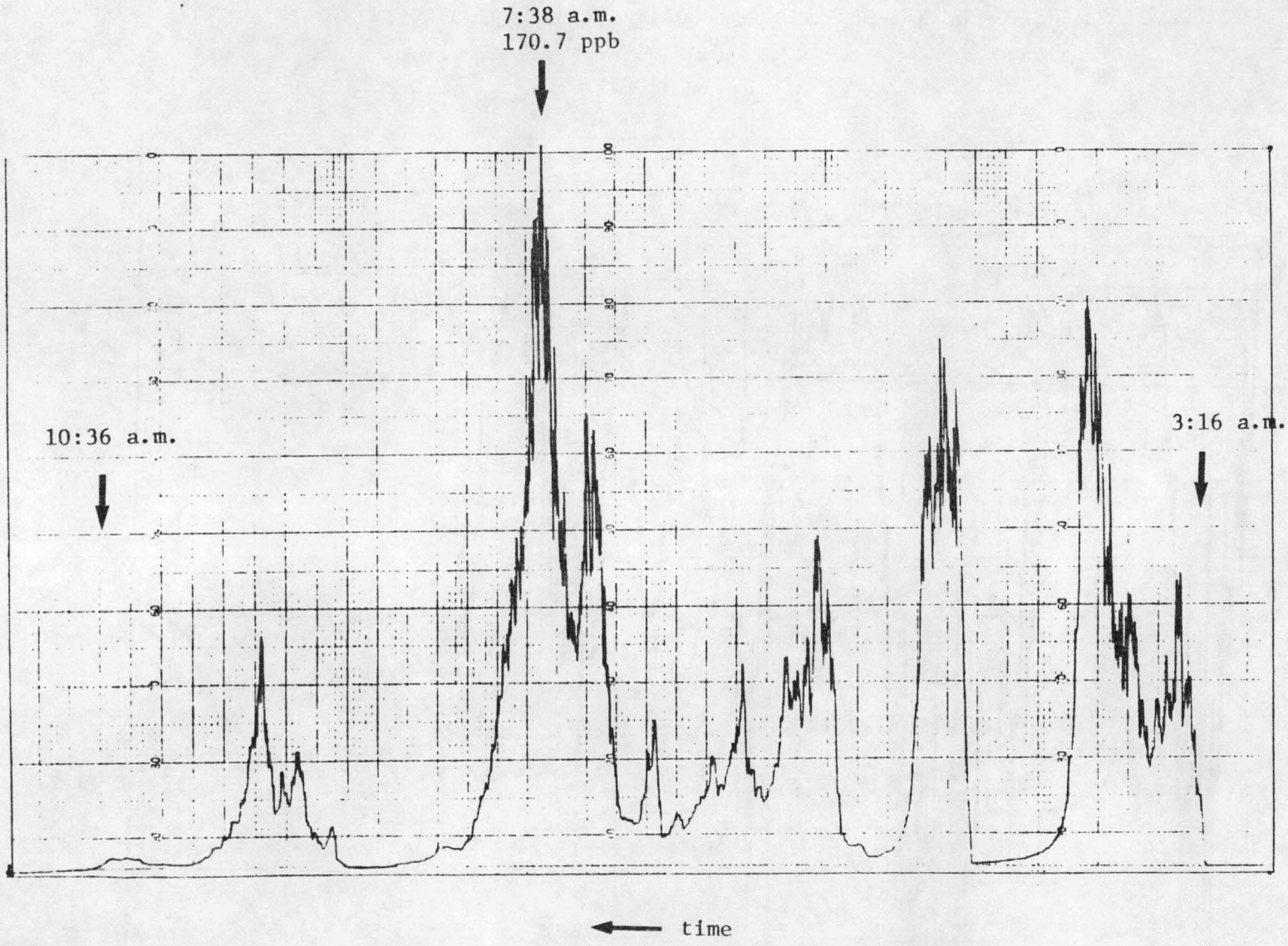

Figure 4. SO_2 Episode Measured at Volcano Village Monitor on 3/2/84. Maximum SO_2 Concentration was 170.7 ppb.

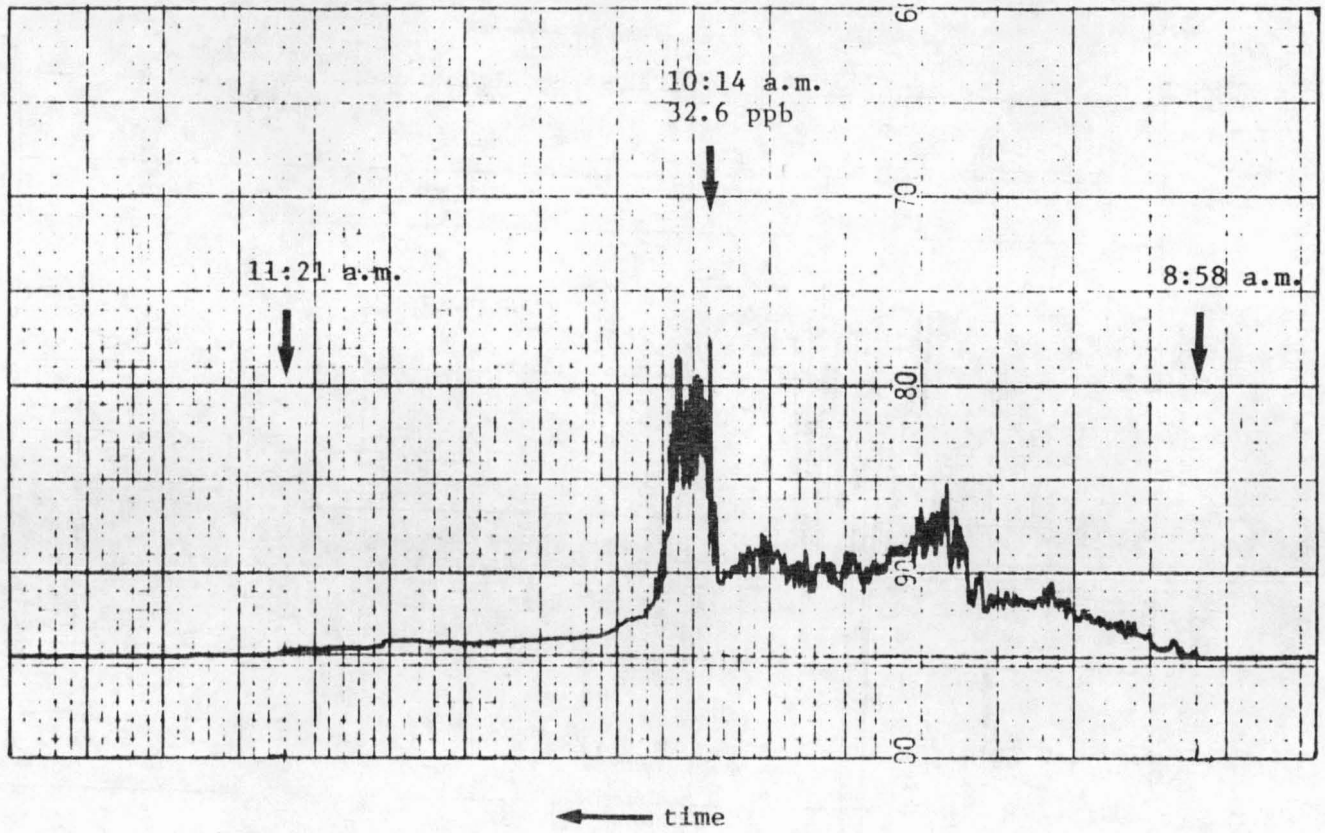

Figure 5. SO_2 Episode Measured at Volcano Village Monitor on 3/4/84. Maximum SO_2 Concentration was 32.6 ppb.

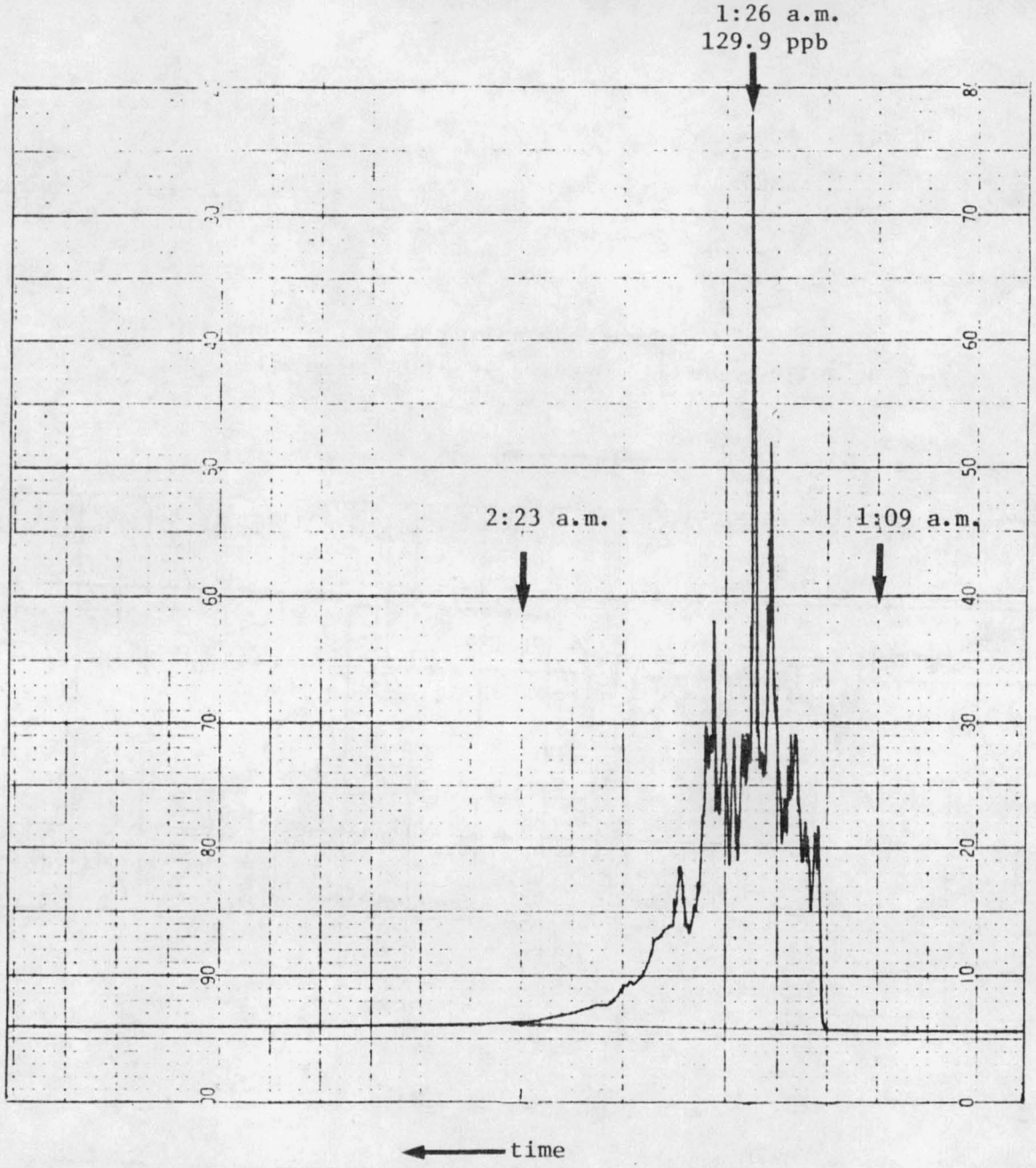

Figure 6. SO_2 Episode Measured at Volcano Village Monitor on 3/5/84. Maximum SO_2 Concentration was 129.9 ppb.

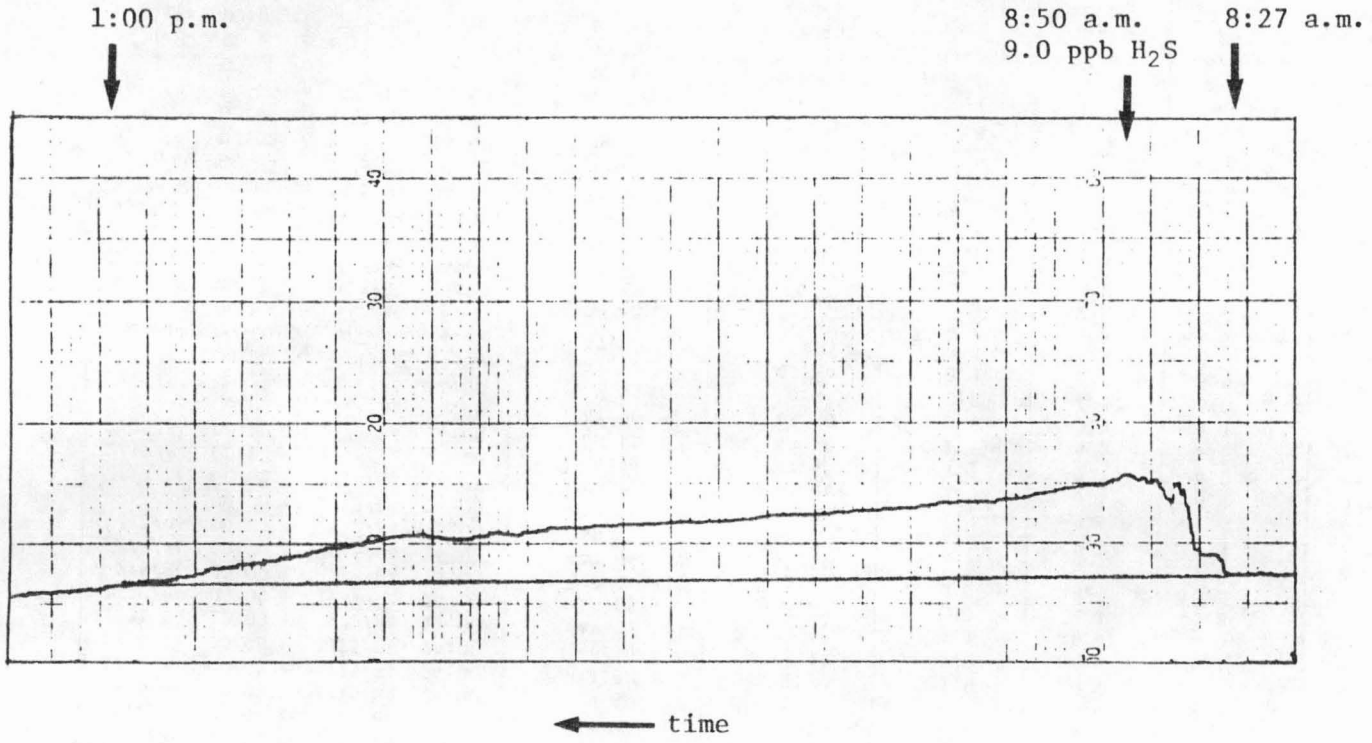

Figure 7. H_2S Episode Measured at Volcano Village Monitor on 4/20/84. Maximum H_2S Concentration was 9.0 ppb.

Table 1

Low-Volume Dichotomous Sampling Summary

Site	Start & Stop Date & Time	Sample Duration (hrs)	Sampled Volume (m^3)	Atmospheric Particulate Concentration ($\mu g/m^3$)			Status
				< 2.5 μ	2.5-15 μ	< 15 μ	
Upper Leilani (Site #2)*	1/6/84 00:00 to 1/7/84 24:00	47.83	46.78	0.8	8.1	8.9	analyzed (XRF)
Volcano Village	1/6/84 00:00 to 1/7/84 24:00	47.29	49.65	2.2	3.3	5.5	analyzed (XRF)
Upper Leilani	1/12/84 00:00 to 1/13/84 24:00	48.23	47.17	1.2	4.8	6.0	analyzed (XRF)
Volcano Village	1/12/84 00:00 to 1/13/84 24:00	47.72	47.82	1.5	1.7	3.2	analyzed (XRF)
Upper Leilani	1/18/84 00:00 to 1/19/84 24:00	11.30	11.05	1.4	5.0	6.4	analyzed (XRF)
Volcano Village	1/18/84 00:00 to 1/19/84 24:00	47.99	48.09	1.4	3.4	4.8	analyzed (XRF)
Upper Leilani	1/24/84 00:00 to 1/25/84 24:00	1.80	1.77	1.9	20.7	22.6	analyzed (XRF)
Volcano Village	1/24/84 00:00 to 1/25/84 24:00	48.17	48.27	1.2	4.9	6.1	analyzed (XRF)
Upper Leilani	1/31/84 12:00 to 2/2/84 11:00	49.37	47.99	1.1	6.4	7.5	analyzed (XRF)
Volcano Village	1/30/84 00:00 to 1/31/84 24:00	48.05	48.43	0.7	2.1	2.8	analyzed (XRF)
Upper Leilani	2/5/84 00:00 to 2/6/84 24:00	48	48.7	2.2	8.3	10.5	analyzed (XRF)
Volcano Village	2/5/84 00:00 to 2/6/84 24:00	47.96	48.34	3.8	4.0	7.8	analyzed (XRF)
Upper Leilani	2/11/84 00:00 to 2/12/84 24:00	48	46.7	1.6	9.9	11.5	analyzed (XRF)
Volcano Village	2/11/84 00:00 to 2/12/84 24:00	48.00	48.38	1.9	5.9	7.8	analyzed (XRF)
Upper Leilani	2/17/84 00:00 to 2/18/84 24:00	48.12	47.06	1.3	7.4	8.7	analyzed (XRF)
Volcano Village	2/17/84 00:00 to 2/18/84 24:00	47.36	47.45	1.3	2.7	4.0	analyzed (XRF)
Upper Leilani	2/23/84 00:00 to 2/24/84 24:00	48.25	47.19	1.1	6.5	7.6	analyzed (XRF)
Volcano Village	2/23/84 00:00 to 2/24/84 24:00	47.96	48.06	0.8	3.3	4.1	analyzed (XRF)
Upper Leilani	2/29/84 00:00 to 3/1/84 24:00	48.05	46.99	0.8	4.2	5.0	analyzed (XRF)
Volcano Village	2/29/84 00:00 to 3/1/84 24:00	47.74	47.84	3.3	2.2	5.5	analyzed (XRF)
Upper Leilani	3/6/84 00:00 to 3/7/84 24:00	47.90	46.85	3.2	5.3	8.5	analyzed (XRF)
Volcano Village	3/6/84 00:00 to 3/7/84 24:00	48.24	48.34	8.4	4.0	12.4	analyzed (XRF)
Upper Leilani	3/12/84 00:00 to 3/13/84 24:00	47.74	46.69	2.8	10.2	13.0	analyzed (XRF)
Volcano Village	3/12/84 00:00 to 3/13/84 24:00	47.80	47.90	1.5	5.6	7.1	analyzed (XRF)
Upper Leilani	3/18/84 00:00 to 3/19/84 24:00	48.12	47.06	1.8	4.6	6.4	analyzed (XRF)
Volcano Village	3/18/84 00:00 to 3/19/84 24:00	48.00	48.10	1.2	8.5	9.7	analyzed (XRF)
Upper Leilani	3/24/84 00:00 to 3/25/84 24:00	48.02	46.96	2.8	2.9	15.7	analyzed (XRF)
Volcano Village	3/24/84 00:00 to 3/25/84 24:00	48.04	47.56	1.5	7.4	8.9	analyzed (XRF)
Upper Leilani	3/30/84 00:00 to 3/31/84 24:00	48.05	46.99	2.0	9.6	11.6	analyzed (XRF)
Volcano Village	3/30/84 00:00 to 3/31/84 24:00	47.81	47.91	1.8	4.6	6.4	analyzed (XRF)
Upper Leilani	4/5/84 00:00 to 4/6/84 24:00	48.30	47.24	2.7	10.4	13.1	analyzed (XRF)
Volcano Village	4/5/84 00:00 to 4/6/84 24:00	47.89	47.99	1.5	4.5	6.0	analyzed (XRF)
Upper Leilani	4/11/84 00:00 to 4/12/84 24:00	48.26	47.20	1.5	7.6	9.1	analyzed (XRF)
Volcano Village	4/11/84 00:00 to 4/12/84 24:00	47.83	47.93	0.9	3.7	4.6	analyzed (XRF)
Upper Leilani	4/17/84 9:00 to 4/18/84 9:00	48.61	47.54	1.5	8.8	10.3	analyzed (XRF)
Volcano Village	4/17/84 00:00 to 4/18/84 24:00	48.04	48.14	0.5	0.9	1.4	analyzed (XRF)
Upper Leilani	4/23/84 00:00 to 4/24/84 24:00	47.96	46.90	1.3	7.9	9.2	analyzed (XRF)
Volcano Village	4/23/84 00:00 to 4/24/84 24:00	47.91	48.01	1.5	2.5	4.0	analyzed (XRF)
Upper Leilani	4/29/84 00:00 to 4/30/84 24:00	48.18	45.39	2.7	11.7	14.4	analyzed (XRF)
Volcano Village	4/29/84 00:00 to 4/30/84 24:00	48.00	48.10	1.1	4.8	5.9	analyzed (XRF)

*Site 2 as described in the first year program is referred to here as Upper Leilani.

Tables 2 and 3 are mean mass and elemental concentrations for the respirable, coarse and inhalable size fractions collected at the two sites which have been analyzed to date.

Chemical mass balance (CMB) source apportionment modeling was conducted for the respirable and inhalable particulate material. Figures 8 and 9 and Tables 4 and 5 give the results of the CMB modeling. The results are consistent with the CMB modeling which was performed on the low-volume particulate ($< \simeq 30\ \mu$) samples collected during the first year survey and are consistent with the size distribution of particles characteristic of specific sources. Sea salt aerosol, road and soil dust, diesel exhaust, and volcanic fumes (primarily secondary sulfate) are the principal respirable and inhalable particulate sources at the Upper Leilani Site and at Volcano Village, as they were for the particulate material collected there with the low-volume samplers operated during the first year survey. (Site 4, where a low-volume sampler was located in the first year survey, is approximately two kilometers from the current Volcano Village monitoring site). The impact of automobile exhaust was minimal as it was during the first year at both locations. Sea salt aerosol was both relatively and absolutely more important at the Upper Leilani Site than it was at Volcano Village. Conversely, volcanic fume was both relatively and absolutely more important at Volcano Village than it was at the Upper Leilani Site. Again, both these trends were also seen during the first year survey. A minor difference between the CMB modeling results produced here and those which were produced with the last year data was noted. The diesel exhaust source did not fit the inhalable or the respirable particulate data well at the Upper Leilani Site, as it did for the low-volume particulate data collected at that site during the first year survey. It is possible that changes in activity (gravel haul trucks or other heavy equipment) or changes in meteorology could have caused a change in the diesel exhaust impact measured at the site, or the apparent difference may be related to the mathematical difficulty of fitting the diesel exhaust source, as it has a poor inorganic fingerprint (mostly organic compounds and elemental carbon). This

Table 2

Mean Mass and Elemental Concentrations - Particulate Material
at Upper Leilani (Site 2)

Mass or Element	Respirable[1] ($\mu g/m^3$)	Coarse[2] ($\mu g/m^3$)	Inhalable[3] ($\mu g/m^3$)
Mass	1.747 ± 0.179	8.698 ± 0.803	10.445 ± 0.982
Al	0.053 ± 0.010	0.137 ± 0.022	0.190 ± 0.032
Si	0.117 ± 0.025	0.299 ± 0.064	0.416 ± 0.089
P	0.008 ± 0.001	0.039 ± 0.003	0.047 ± 0.004
S	0.153 ± 0.026	0.209 ± 0.021	0.362 ± 0.047
Cl	0.208 ± 0.030	1.707 ± 0.204	1.915 ± 0.234
K	0.020 ± 0.002	0.083 ± 0.006	0.103 ± 0.008
Ca	0.017 ± 0.003	0.096 ± 0.013	0.113 ± 0.016
Ti	0.002 ± 0.000	0.006 ± 0.001	0.008 ± 0.001
V	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Cr	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Mn	0.000 ± 0.000	0.001 ± 0.000	0.001 ± 0.000
Fe	0.016 ± 0.003	0.050 ± 0.009	0.066 ± 0.012
Ni	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Cu	0.000 ± 0.000	0.001 ± 0.000	0.003 ± 0.001
Zn	0.001 ± 0.000	0.002 ± 0.001	0.000 ± 0.000
Ga	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
As	0.001 ± 0.000	0.000 ± 0.000	0.001 ± 0.000
Se	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Br	0.004 ± 0.001	0.003 ± 0.000	0.007 ± 0.001
Rb	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Sr	0.000 ± 0.000	0.002 ± 0.000	0.002 ± 0.000
Y	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Zr	0.003 ± 0.002	0.001 ± 0.000	0.004 ± 0.002
Mo	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Pd	0.000 ± 0.000	0.001 ± 0.000	0.001 ± 0.000
Ag	0.004 ± 0.003	0.000 ± 0.000	0.004 ± 0.003
Cd	0.003 ± 0.002	0.003 ± 0.001	0.006 ± 0.003
In	0.004 ± 0.003	0.001 ± 0.000	0.005 ± 0.003
Sn	0.001 ± 0.000	0.002 ± 0.000	0.003 ± 0.000
Sb	$\leq$ 0.013	$\leq$ 0.002	$\leq$ 0.015
Ba	$\leq$ 0.019	$\leq$ 0.012	$\leq$ 0.031
La	$\leq$ 0.040	$\leq$ 0.020	$\leq$ 0.060
Hg	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Pb	0.012 ± 0.001	0.002 ± 0.000	0.014 ± 0.001

[1]Respirable = < 2.5 μ in aerodynamic diameter
[2]Coarse = 2.5 - 15 μ in aerodynamic diameter
[3]Inhalable = < 15 μ in aerodynamic diameter

The uncertainty columns in this table are standard errors.
The means are based on 20 dichotomous samples collected between 1/6/84 and 4/30/84.

Table 3

Mean Mass and Elemental Concentrations - Particulate Material at Volcano Village

Mass or Element	Respirable[1] ($\mu g/m^3$)	Coarse[2] ($\mu g/m^3$)	Inhalable[3] ($\mu g/m^3$)
Mass	1.890 ± 0.387	3.801 ± 0.349	5.691 ± 0.736
Al	0.048 ± 0.007	0.115 ± 0.021	0.163 ± 0.028
Si	0.078 ± 0.015	0.253 ± 0.059	0.331 ± 0.074
P	0.008 ± 0.002	0.015 ± 0.001	0.023 ± 0.003
S	0.247 ± 0.074	0.119 ± 0.010	0.366 ± 0.084
Cl	0.038 ± 0.009	0.638 ± 0.081	0.676 ± 0.090
K	0.013 ± 0.002	0.038 ± 0.004	0.051 ± 0.006
Ca	0.007 ± 0.001	0.060 ± 0.011	0.067 ± 0.012
Ti	0.001 ± 0.000	0.005 ± 0.001	0.006 ± 0.001
V	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Cr	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Mn	0.000 ± 0.000	0.001 ± 0.000	0.001 ± 0.000
Fe	0.009 ± 0.002	0.042 ± 0.008	0.051 ± 0.010
Ni	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Cu	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Zn	0.001 ± 0.000	0.001 ± 0.000	0.002 ± 0.000
Ga	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
As	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Se	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Br	0.002 ± 0.000	0.002 ± 0.000	0.004 ± 0.000
Rb	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Sr	0.000 ± 0.000	0.001 ± 0.000	0.001 ± 0.000
Y	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Zr	0.001 ± 0.000	0.001 ± 0.000	0.002 ± 0.000
Mo	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Pd	0.000 ± 0.000	0.001 ± 0.000	0.001 ± 0.000
Ag	0.001 ± 0.000	0.000 ± 0.000	0.001 ± 0.000
Cd	0.001 ± 0.000	0.001 ± 0.000	0.002 ± 0.000
In	0.001 ± 0.000	0.000 ± 0.000	0.001 ± 0.000
Sn	0.001 ± 0.000	0.001 ± 0.000	0.002 ± 0.000
Sb	$\leq$ 0.003	$\leq$ 0.002	$\leq$ 0.005
Ba	$\leq$ 0.008	$\leq$ 0.007	$\leq$ 0.015
La	$\leq$ 0.008	$\leq$ 0.009	$\leq$ 0.017
Hg	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Pb	0.003 ± 0.000	0.001 ± 0.000	0.004 ± 0.000

[1]Respirable = < 2.5 μ in aerodynamic diameter
[2]Coarse = 2.5 - 15 μ in aerodynamic diameter
[3]Inhalable = < 15 μ in aerodynamic diameter

The uncertainty columns in this table are standard errors.
The means are based on 20 dichotomous samples collected between 1/6/84 and 4/30/84.

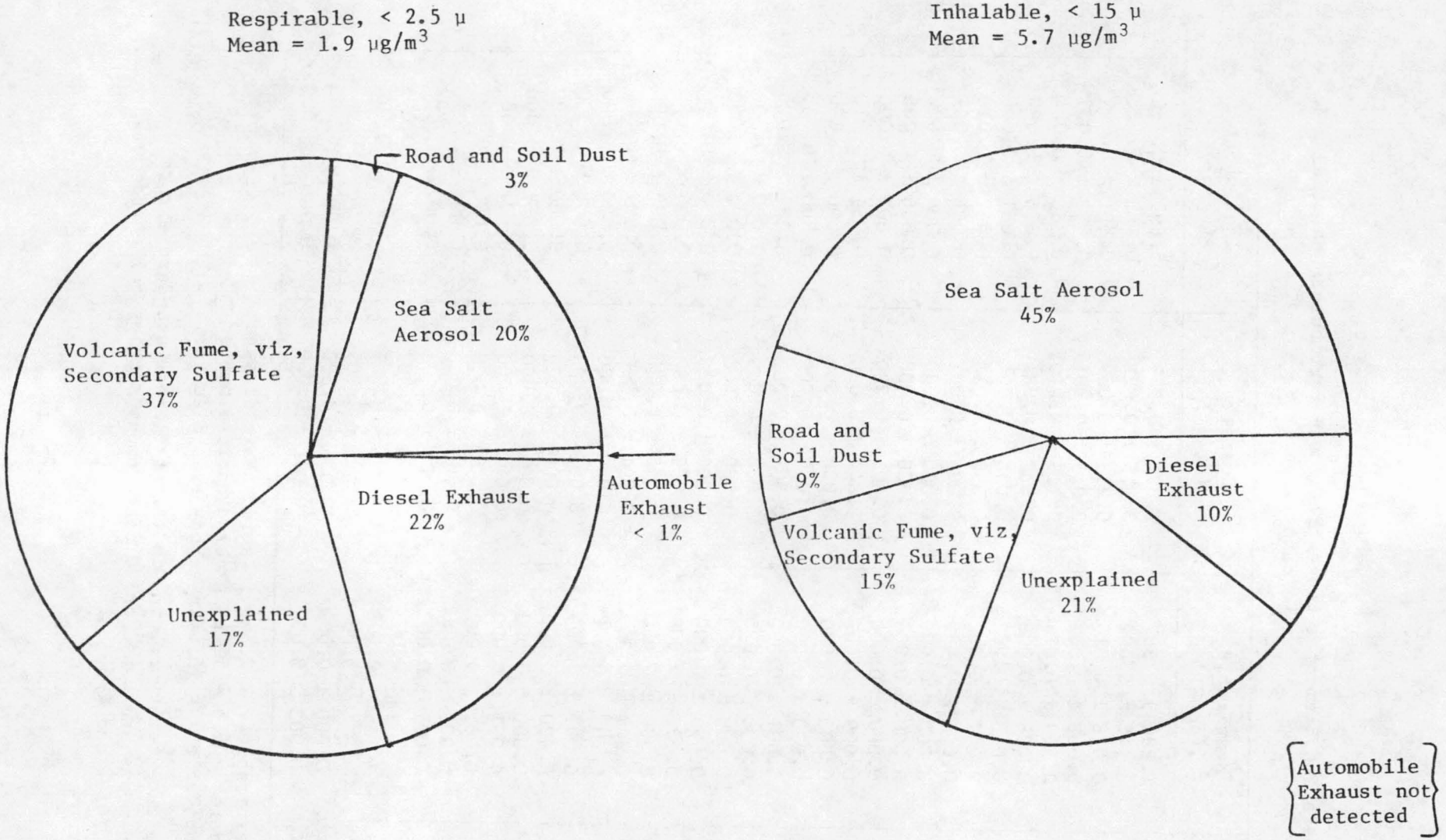

Figure 8. Estimated Source Contributions to Atmospheric Respirable and Inhalable Particulate Levels at the Volcano Village Site. (Based on samples collected 1/6/84 - 4/30/84).

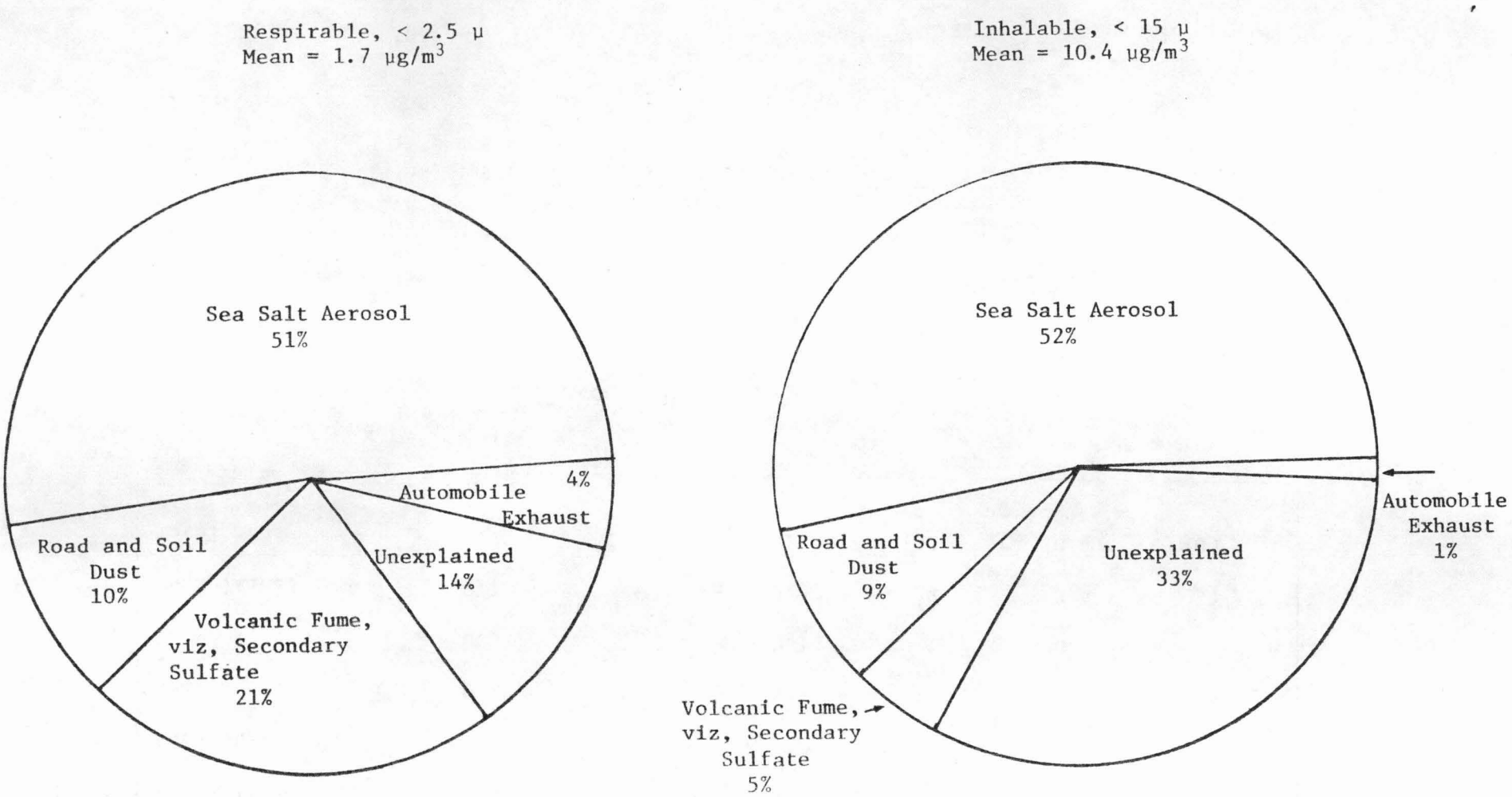

Figure 9. Estimated Source Contributions to Atmospheric Respirable and Inhalable Particulate Levels at the Upper Leilani Site. (Based on samples collected 1/6/84 - 4/30/84)

Table 4

CMB Results by Particle Size - Upper Leilani Site

Category	Fine, respirable < 2.5 μ ($\mu g/m^3$)	(Percent)	Coarse 2.5 - 15 μ ($\mu g/m^3$)	(Percent)	Inhalable < 15 μ ($\mu g/m^3$)	(Percent)
Sea Salt Aerosol	0.89	51	4.4	51	5.5	52
Automobile Exhaust	0.074	4	*	*	0.078	1
Road and Soil Dust	0.17	10	0.83	10	0.91	9
Volcanic Fume	0.37	21	0.18	1	0.53	5
Unexplained Mass	0.25	14	3.3	38	3.4	33
Total Mass	1.75	100	8.70	100	10.4	100

* below detection limit

Table 5

CMB Results by Particle Size - Volcano Village

Category	Fine, respirable < 2.5 μ ($\mu g/m^3$)	(Percent)	Coarse 2.5 - 15 μ ($\mu g/m^3$)	(Percent)	Inhalable < 15 μ ($\mu g/m^3$)	(Percent)
Sea Salt Aerosol	0.37	20	1.62	43	2.58	45
Automobile Exhaust	0.008	0.4	*	*	*	*
Diesel Exhaust	0.41	22	*	*	0.57	10
Road and Soil Dust	0.065	3	0.36	9	0.50	9
Volcanic Fume	0.70	37	0.31	8	0.84	15
Unexplained Mass	0.34	18	1.51	40	1.20	21
Total Mass	1.89	100	3.80	100	5.69	100

*below detection limit

discrepancy will be investigated in more detail during the preparation of the final report when more data are available.

The mass distribution between the fine (< 2.5 μ) and coarse (2.5 - 15 μ) sized particulate material determined by CMB modeling is consistent with what is characteristic of particles originating from the various sources. The sea salt and road and soil dust particles were at higher concentrations in the coarse size fraction, whereas automobile exhaust, diesel exhaust, and volcanic fume were at higher concentration in the fine size fraction (Tables 4 and 5). This distribution is what would be expected based on previous studies with these particle sources. In general, particles originating from high temperature (e.g., combustion sources) and secondary particles (formed in the atmosphere) are predominately in the fine size fraction, while particles entering the atmosphere by low temperature physical processes are predominately in the coarse size fraction.

An estimate of the size distribution of atmospheric particles at the two sites can be made by comparing the mean mass concentration measured during the first year survey (low-volume and high-volume samplers), and the mean mass measured during the current study (dichotomous samplers). The low-volume sampler inlet is configured such that particles with an aerodynamic diameter of greater than approximately 30 μ are excluded. Hence, the difference in mass concentrations between values determined with the high-volume samples and values determined with the low-volume samples correspond to the mass of particles greater than approximately 30 μ in size. Similarly, the differences in mass concentration between the values determined with the low-volume samples and the sum of the fine and coarse dichotomous filters correspond to the mass concentration of particles between 15 μ and approximately 30 μ in size. Finally, the fine and coarse dichotomous filters collect particles of less than 2.5 μ, and between 2.5 μ and 15 μ in size, respectively. As can be seen in Table 6, while the TSP at the Upper Leilani Site is considerably higher than at Volcano Village, the respirable (< 2.5 μ) size particulate concentrations are about the same. The major

Table 6

Size Distribution of Atmospheric Particles

Particle Size Range	Upper Leilani ($\mu g/m^3$)	Upper Leilani (% of total)	Volcano Village ($\mu g/m^3$)	Volcano Village (% of total)
< 2.5 μ	1.7	10	1.9	16
2.5 μ - 15 μ	8.7	50	3.8	32
15 μ - ≃ 30 μ	4.3	24	3.4	28
< ≃ 30 μ	2.8	16	2.9	24
Total (TSP)	17.5	100	12.0	100

difference in the TSP mass concentrations occurs in the coarse (2.5 - 15 μ) size fraction. The Upper Leilani Site has more than twice the mass concentration as the Volcano Village area in the coarse size category. This, of course, implies that the inhalable (< 15 μ) mass concentration is also much higher at the Upper Leilani Site. It should be emphasized that the preceeding size comparison is approximate due to the different time periods which were being sampled by the high-volume and low-volume samples, as compared to the dichotomous samplers, and due to the two different sites which were used in the Volcano Village area. However, it is clear that the concentration of respirable particles at the two locations is not markedly different, whereas the concentration of inhalable particles is much higher at the Upper Leilani Site.

IV. Scheduled Future Work

The following tasks remain to be completed under the current 1984 program.

- The continued operation of the SO_2/H_2S monitor at Volcano Village through December 31, 1984.
- The continued operation of the dichotomous samplers at the Volcano Village and the Upper Leilani Sites through December 31, 1984.
- Mass, elemental XRF, and CMB source analyses of the dichotomous samples.
- Reduction of continuous SO_2 and H_2S data records.
- Compilation and comparison of meteorological data and volcanic activity records with the SO_2 and H_2S gas data and the inhalable and respirable particulate data.
- Literature survey of inhalable and respirable particulate levels typical of other locations, and of biological impact levels for comparison with the levels obtained during this study.
- Final report preparation. A March, 1985, completion date is anticipated.